JCSDA Quarterly

No. 21, December 2007

Joint Center for Satellite Data Assimilation • 5200 Auth Road • Camp Springs • MD • 20746 *Editor: George Ohring*

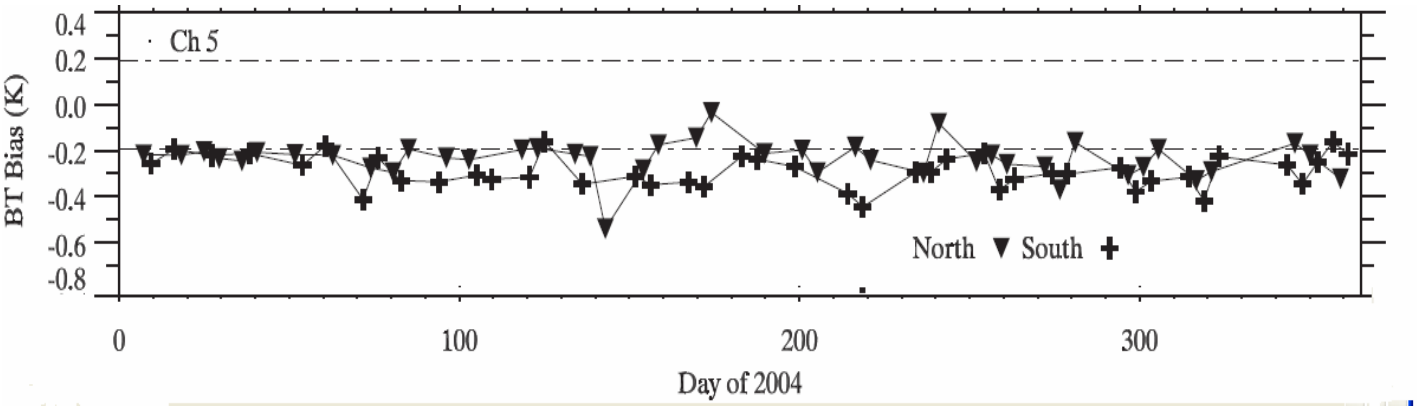
NOAA……..NASA……..US Navy……..US Air Force *Web-site: www.jcsda.noaa.gov*

News in This Quarter

Science and Implementation Update

The Global Space-based Inter-Calibration System

Time series of Mean Difference between AIRS and HIRS Brightness Temperatures in 2004



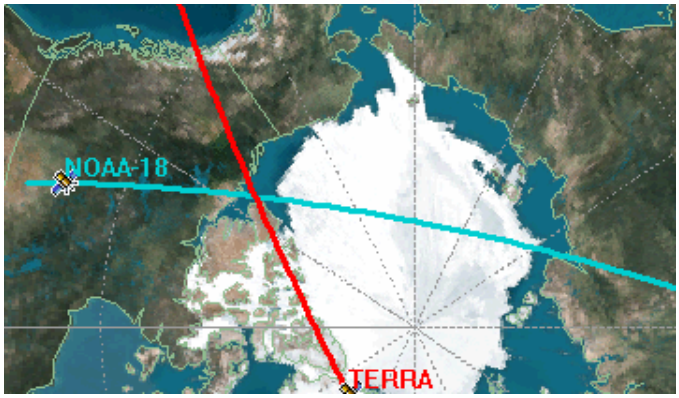
Calibration of HIRS Channel 5 (weighting function peak at ~400 mb) using AIRS observations at Simultaneous Nadir Overpasses in North and South Polar Regions in 2004. Mean brightness temperature bias (BT) of HIRS Ch.5 is 0.25 K, with uncertainty of only 0.1 K. (After Cao et al.)

A new WMO program will lead to improved assimilation of satellite observations in NWP models.

The Global Space-based Inter-Calibration System (GSICS) was established to improve the calibration and inter-calibration of operational satellite sensors to deliver the more accurate observations needed by modern day weather forecasting and to permit early detection of climate change. The overarching goal is to ensure the comparability of satellite measurements provided at different times, by different instruments under the responsibility of different satellite operators.

Current NWP data assimilation systems correct for instrument bias by comparing the satellite observations with simulated observations calculated from the model variables. Mean differences are assumed to be due to the bias in the satellite observations (the model and its radiative transfer calculation are assumed to have no bias). The larger the instrument bias, the greater the error using this method. If instrumental accuracies can be improved, the need to correct such observations for use in weather prediction would be minimized, if not eliminated. In addition, it would then be possible to assume that the observations are correct, thus facilitating discovery of model errors, and their correction. In both cases, gains in forecast accuracy can be expected.

A major objective of GSICS is ensure that instruments meet specification, pre-launch tests are traceable to SI (International System) standards, and the on-orbit satellite instrument observations are well calibrated by means of careful analysis of instrument performance, satellite intercalibration, and validation with reference sites. A key initial strategy is the use of high accuracy research satellite sensors – such as AIRS, MODIS, and IASI – to serve as in-orbit standards to calibrate operational sensors. Such intercalibrations are performed at the crossing points of two satellites – e.g., at Simultaneous Nadir Overpasses.



Polar Orbiting Satellites Cross Each Other Allowing Intercalibration using Simultaneous Nadir Overpass Method

Agencies participating in GSICS include NOAA, NASA, NIST, CNES, EUMETSAT, JMA, and KMA. The GSICS consists of a GSICS Executive Panel, GSICS Coordination Center (GCC), and GSICS Processing and Research Centers (GPRCs). GSICS also includes a Research Working Group (GRWG), a Data Working Group (GDWG) and critical Calibration Support Segments (CSS).

NOAA/NESDIS plays a leading role in GSICS, chairing the Executive Panel, and operating the GSICS Coordination Centre (GCC). More information at http://www.orbit.nesdis.noaa.gov/smcd/spb/calibration/icvs/GSICS/index.html
(George Ohring, JCSDA)

Global Atmospheric Research Programme
THORPEX

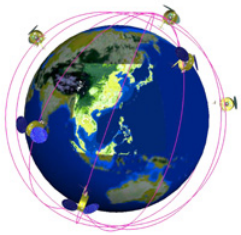
A planning workshop related to the THORPEX Pacific – Asian Regional Campaign (T-PARC) took place in Princeville, Kauai, Hawaii, 4-6 December 2007, see: http://www.ucar.edu/na-thorpex/PARC.html
Details related to the four phases of the campaign: Genesis, recurvature, and extra-tropical transition of tropical cyclones (Aug-Sept 2008), and Winter Storms (Jan-Mar 2009, see: http://www.emc.ncep.noaa.gov/gmb/ens/T-PARC_IPY.html) were discussed, as well as links with other ongoing projects, including the International Polar Year (IPY), and the THORPEX Interactive Grand Global Ensemble (TIGGE) project.

The THORPEX Pacific Asian Regional Campaign (T-PARC) is a multi-national field campaign that addresses the shorter-range dynamics and forecast skill of one region (Eastern Asian and the western North Pacific) and its impact on the medium-range dynamics and forecast skill of downstream regions (eastern North Pacific, North America and perhaps stretching to Europe).

The Winter Storms component of T-PARC will address failures in wintertime weather forecasts in the middle latitudes and the Arctic. These occur on a regular basis, especially at a longer lead time, say 3-5 days. Inaccuracies in the numerical forecasts can be traced back to two sources: imperfect model and imperfect initial conditions due to data assimilation systems with insufficient observations. With an improving global observational network and advanced observing systems, the challenges to the research community and operational centers are how to effectively design and utilize these voluminous data, especially the satellite data over cloudy areas that need calibration and validation and how to identify and fill any remaining data gaps.

Meanwhile, the THORPEX TIGGE/GIFS (Global Interactive Forecast System) Working Group began the development of plans for the second phase of TIGGE and GIFS. Some preliminary plans, related to ensemble forecast data on Tropical and Extra-tropical Cyclones, were discussed at and endorsed by the T-PARC workshop. According to these plans, TC-related ensemble data would be made available by the producing Numerical Weather Prediction (NWP) centers in real time during the T-PARC experiment.
(Zoltan Toth, NOAA/NCEP)

Cosmic Corner



GPS radio occultation (GPSRO) observations have been assimilated into NOAA/NCEP's global data assimilation system since May 1st 2007. Research continues at the JCSDA to improve the use of GPSRO observations by re-computing statistics to update the quality control checks and error characterization of the observations. In addition, evaluation of bending angle versus refractivity assimilations and accounting for horizontal gradients of refractivity are under investigation.

In preparation for an upgrade of NOAA's Climate Forecast System, NCEP is planning to assimilate post-processed GPSRO observations from the COSMIC and CHAMP missions into its Global Reanalysis and Seasonal Reforecast system (CFSRR project). This project will undertake new reanalysis of the atmosphere, ocean, sea ice and land over the 31-year period (1979-2009).

The COSMIC satellite that had lost communication for two months has finally started providing data again. The reason for this gap is still under investigation at UCAR/CDAAC. Two other satellites still provide lower amounts of observations due to power issues.
(Lidia Cucurull, JCSDA)

Oversight Board Meets

The JCSDA Management Oversight Board (MOB) met November 21, 2007, at JCSDA Headquarters in Camp Springs, MD. In his opening remarks, MOB Chair, Dr. Louis Uccellini, lauded the JCSDA for advancing its research priorities and emphasized the need to focus on accelerating operational implementations.

Lars Peter Riishojgaard, JCSDA Director, summarized recent significant accomplishments, including: assimilation of COSMIC observations within a year of launch, implementation of the Gridpoint Statistical Interpolation (GSI) analysis system, and assimilation of AIRS (all FOVs), METOP AMSU, HSB, and HIRS, and GOES 1x1 km FOV sounder radiances at NOAA/NCEP; the further development, integration of RTTOVS, and expanding use of JCSDA's Community Radiative Transfer Model (CRTM); progress in implementing the NASA Goddard Global Ozone Chemistry Aerosol Radiation and Transport Model as an offline adjunct of the NOAA GSI analysis system and in transitioning NASA's land information system (LIS) as the support-infrastructure for JCSDA land data assimilation; the Navy NRL/UK MetOffice development of a Unified Pre-Processor designed to mitigate the significant calibration anomalies of the SSMIS, NRL's progress in developing the world's first operational aerosol optical depth data assimilation system to aid in the forecast of air quality and visibility, transition of NRL's ozone chemistry model to NOAA's NCEP, and the Navy NRL/NASA Goddard development and application of the powerful adjoint method for evaluating the impact of different observation types; and the Air Force's incorporation into its WRF model of JCSDA's CRTM and a new bias correction, completion of the Initial Operating Capability of a hybrid data assimilation system, and evaluation of new algorithms for the Land Information System.

Additional highlights included the JAS Special Issue (see article this issue), the first JCSDA Executive retreat, the productive meeting of JCSDA's Science Steering Committee, and the successful JCSDA Data Assimilation Training Workshop at the University of Maryland. Dr. Riishojgaard also reviewed the status of the JCSDA Strategic Plan and Program Plan, which are currently being revised. Wayman Baker, JCSDA Chief Administrative Officer, summarized the status of the JCSDA Memorandum of Understanding, Terms of Reference, and FY08 Annual Operating Plan.

Throughout the meeting, the Board engaged in productive discussions of a number of issues, including transition of research to operations, computer resources, and coordination of efforts among the JCSDA partners.

In addition to Louis Uccellini, Chair, the Board consists of Al Powell (NOAA/NESDIS), Franco Einaudi (NASA/GSFC), Simon Chang (USN/NRL), Mike Uhart (NOAA/OAR), and Col Mark Zettlemoyer (USAF/A30-WX).

A follow-up meeting is scheduled for January 2008.
(George Ohring, Ken Carey, JCSDA)

JAS Special Section

The November 2007 issue of the Journal of Atmospheric Sciences features a Special Collection of articles based on papers presented at the JCSDA sponsored International Workshop on Assimilation of Satellite Cloud and Precipitation Observations in Numerical Weather Prediction Models. To date, the assimilation of satellite measurements in numerical weather prediction models has focused on the clear atmosphere. But satellite observations in the visible, infrared, and microwave provide a great deal of information on clouds and precipitation. This Special Collection describes how to use this information to initialize clouds and precipitation in models. Since clouds and precipitation often occur in sensitive regions for forecast impacts, such improvements are likely necessary for continuing to achieve significant gains in weather forecasting. The Special Collection includes review articles on satellite observations of clouds and precipitation, parameterizations of clouds and precipitation in NWP models, radiative transfer in cloudy/precipitating atmospheres, and assimilation of cloud and precipitation observations, as well as research papers on these topics. Paper titles and authors are listed below:

Assimilation of Satellite Cloud and Precipitation Observations in Numerical Weather Prediction Models: Introduction to the JAS Special Collection - *Ronald M. Errico, George Ohring, Peter Bauer, Brad Ferrier, Jean-François Mahfouf, Joe Turk, and Fuzhong Weng*

The Remote Sensing of Clouds and Precipitation from Space: A Review - *Graeme L. Stephens and Christian D. Kummerow*
Cloud and Precipitation Parameterizations in Modeling and Variational Data Assimilation: A Review - *Philippe Lopez*

Issues Regarding the Assimilation of Cloud and Precipitation Data - *Ronald M. Errico, Peter Bauer, and Jean-François Mahfouf*

Advances in Radiative Transfer Modeling in Support of Satellite Data Assimilation - *Fuzhong Weng*

Millimeter-Wave Precipitation Retrievals and Observed-versus-Simulated Radiance Distributions: Sensitivity to Assumptions - *Chinnawat Surussavadee and David H. Staelin*

Interpretation of AIRS Data in Thin Cirrus Atmospheres Based on a Fast Radiative Transfer Model - *Qing Yue, K. N. Liou, S. C. Ou, B. H. Kahn, P. Yang, and G. G. Mace*

Impact of the Vertical Variation of Cloud Droplet Size on the Estimation of Cloud Liquid Water Path and Rain Detection - *Ruiyue Chen, Fu-Lung Chang, Zhanqing Li, Ralph Ferraro, and Fuzhong Weng*

SHDOMPPDA: A Radiative Transfer Model for Cloudy Sky Data Assimilation - *K. Franklin Evans*

Assimilation of Precipitation Information Using Column Model Physics as a Weak Constraint - *Arthur Y. Hou and Sara Q. Zhang*

Assimilation of Satellite Cloud Data into the GMAO Finite-Volume Data Assimilation System Using a Parameter Estimation Method. Part I: Motivation and Algorithm Description - *Peter M. Norris and Arlindo M. da Silva*

A Fast Cloud Overlap Parameterization for Microwave Radiance Assimilation - *Christopher W. O'Dell, Peter Bauer, and Ralf Bennartz*

Satellite Data Assimilation in Numerical Weather Prediction Models. Part II: Uses of Rain-Affected Radiances from Microwave Observations for Hurricane Vortex Analysis - *Fuzhong Weng, Tong Zhu, and Banghua Yan*

People

Lidia Cucurull Named NOAA Team Member of the Month

JCSDA's Lidia Cucurull was named NOAA Team Member of the Month for November 2007 for the excellence of her recent work on the COSMIC project. Dr. Lidia Cucurull led the effort at the Joint Center for Satellite Data Assimilation in testing and developing the methodology for assimilating observations of the Constellation Observing System for Meteorology, the Ionosphere and Climate (COSMIC) into NOAA's Global Forecast System. As a result of her efforts, COSMIC data were operationally assimilated on May 1, 2007- only one year after the launch of this advanced satellite system - and five-day global upper air forecasts improved by three percent. The rapid introduction of this new satellite technology into NOAA's operational prediction model was an outstanding achievement.

The NOAA Team Member of the Month award recognizes excellence for demonstrated and sustained effort in advancing NOAA's mission.

The Constellation Observing System for Meteorology, the Ionosphere and Climate (COSMIC) is a high profile international mission to produce new satellite observations that complement conventional ones to improve weather and climate analyses and forecasts. COSMIC, a U.S.-Taiwan partnership is a constellation of six satellites that probe the atmosphere using radio occultation. Each COSMIC satellite intercepts a GPS satellite signal as it passes through the atmosphere close to the horizon. Variations in electron density, air density, temperature, and moisture bend the signal and change its speed. By measuring these shifts in the signal, scientists can determine the atmospheric conditions that produced them.

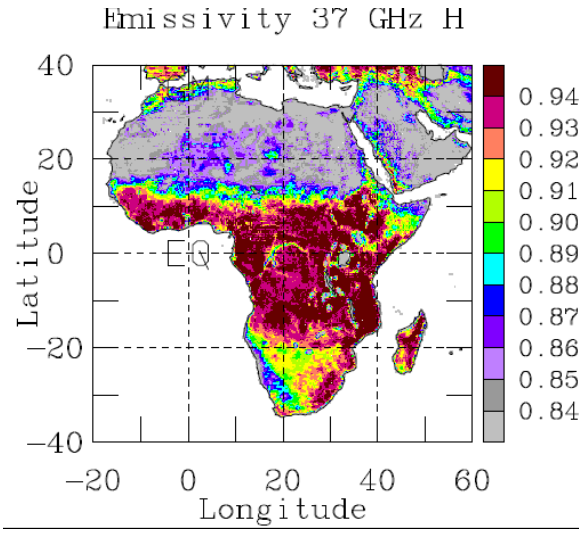
Congratulations, Lidia.

JCSDA's Yong Han at UK Met Office

Yong Han, NESDIS Center for Satellite Applications and Research and a member of the JCSDA Community Radiative Transfer Model (CRTM) Team, implemented two JCSDA sub-models of the fast CRTM into the Radiative Transfer (RT) for TOVS (RTTOV) model during his recent visit to the Met Office, October 18 to November 20, 2007. The sub-models were developed for Special Sensor Microwave Imager/Sounder (SSMIS) channels 19-22 and Advanced Microwave Sounding Unit (AMSU)-A channel 14, respectively, in which the effect of Zeeman-splitting is included. The phenomenon of Zeeman-splitting must be taken into account to assimilate radiance observations of the upper stratosphere (see Dr Han's article on this topic in the June 2007 Newsletter). Dr. Han's visit is part of a scientific exchange program between the Joint Center for Satellite Data Assimilation and the UK MetOffice. Dr. Roger Saunders of the Met Office implemented the RTTOV model into the CRTM during his visit to the JCSDA last year. The CRTM and RTTOV are both fast radiative transfer models used in assimilation of satellite observations. The CRTM, developed by the JCSDA is widely used in the United States, while the RTTOV model is used by many European centers. Having both models within the same software framework facilitates comparisons and extraction of the best features of each model for operational applications.

Outlook for Next Quarter

Special Publication on Surface Radiative Properties



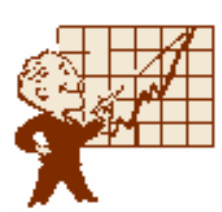
A Special Issue of the IEEE Transactions on Geoscience and Remote Sensing (TGARS) will be devoted to papers from the First International Workshop of Remote Sensing and Modeling of Surface Properties. The workshop, held in Paris in 2006, and sponsored by NOAA/NESDIS/Center for Satellite Applications and Research and Observatoire de Paris, focused on the of different surface types at wavelengths ranging from the visible to the microwave. Knowledge of surface radiative properties is critical for assimilating satellite observations of the surface as well as observations of the atmosphere that are affected by radiation reflected or emitted by the surface. Sixty-two international specialists and scientists, including representatives of the major NWP centers: NCEP, ECMWF, the MetOffice, MeteoFrance, and Meteorological Service of Canada, participated. More than a dozen papers from the workshop will appear in the Special Issue.

Session on Satellite Data Assimilation at AMS Meeting

The AMS Annual Meeting in New Orleans, Jan.20-24, 2008, will include a special session on Satellite Data Assimilation as part of the Fourth Symposium on Future National Operational Environmental Satellites. Chaired by JCSDA Director Lars Peter Riishojgaard, the session includes papers summarizing current and planned satellite data assimilation activities at ECMWF, MetOffice, NRL, and NCEP.

Symposium Keynote Speaker Jack Hayes, Director of NOAA's National Weather Service, will address the issue of **Bridging between Research and Operations.** Another Symposium session of interest is on Societal Benefits: Improving Models and Tools. This session also includes presentations on satellite data assimilation and is co-chaired by JCSDA Director, Michele Rieneker, NASA/GSFC/GMAO, and John Haynes NASA. An additional note: JCSDA's Ken Carey is Program Co-chair of the AMS 2008 Annual Meeting.

JCSDA Seminars



Jan. 16, 2008	**Al Powell**	**Director, NOAA/NESDIS/ STAR**	**The NOAA Strategic Satellite Plan**
TBD	**Oliver Reitebuch**	**German Aerospace Center**	**Status of the Atmospheric Dynamics Mission ADM-Aeolus**
March 19, 2008	**David Crisp**	**Jet Propulsion Laboratory**	**The Orbiting Carbon Observatory (OCO)**

Editor's Note: Unsolicited articles for the JCSDA Quarterly Newsletter are encouraged as are suggestions for seminar speakers or topics. Please send them to George.Ohring@noaa.gov.